Center Independent Research & Development: GSFC IRAD

Deposition of Enhanced Protected Aluminum for Broadband Applications

Completed Technology Project (2017 - 2018)

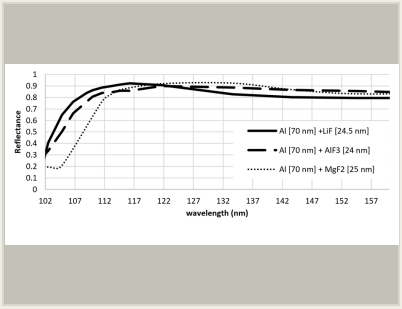
Project Introduction

The ***objective of this project*** is to optimize the design and fabrication of high reflectance /low absorption broadband UV coating for space telescope mirrors. This is a technology ***maturation for risk reduction*** effort. The ***innovative elements*** of our approach include: (1) deposit aluminum (Al) with an overcoat of lithium fluoride (LiF) using thermal resistive evaporation, (2) increasing the fluorine efficiency of the films, (3) overcoat the treated coating with a few monolayers of magnesium fluoride (MgF_2) and aluminum tri-fluoride (AlF_3).

Pure aluminum will achieve high reflectance at the proposed spectral range, however, it becomes oxidized immediately after deposition, thus requires an overcoat to protect from oxidation. LiF is usually the material of choice to use as an overcoat of aluminum due to its high band gap energy and low absorption properties in the FUV, however, its performance is severely hindered due to its hygroscopic nature as its RMS surface roughness increases when exposed to atmospheric conditions. A thin overcoat of a more durable and space flight proven material such as MgF_2 or AlF_3 layer will be applied to the LiF layer to protect the material while minimizing the absorption effects on the FUV optical properties.

Anticipated Benefits

Broadband high reflectance broadband coatings are an essential requirement for interdisciplinary space science missions such as LUVOIR and HABex which will merge ultraviolet astrophysics and visible exoplanet sciences. Enhancing the protected aluminum coating technology will improve on Hubble's capabilities by capturing photons below the 115 nm spectral range while combining the capability of the Far Ultraviolet Spectroscopic Explorer (*FUSE*) instrument. By producing low absorption coatings in the FUV, instrument design freedom would be allowed as more elements can be added for aberration correction, a higher spectral radiance will be obtained through the system, and the signal-to-noise ratio will be increased.



State-of-the-art aluminum coating with different metal fluoride overcoats.

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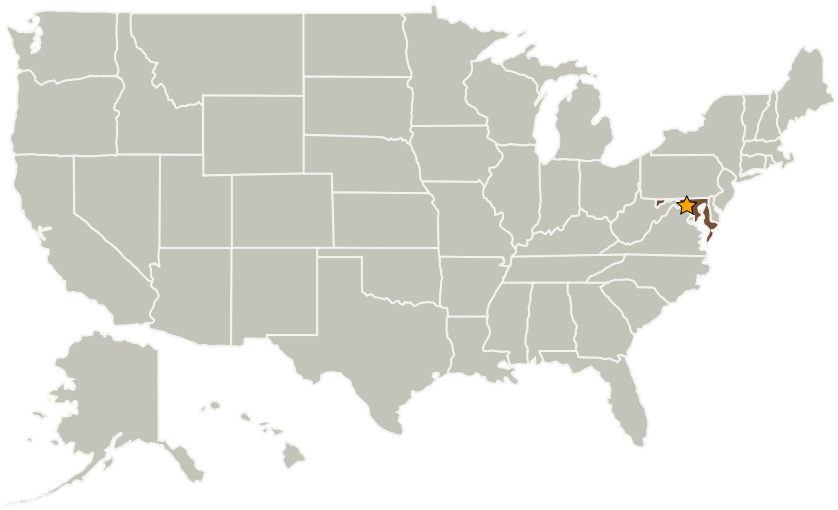

Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
University of Maryland Nanocenter	Supporting Organization	Academia	College Park, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Megan E Eckart
Timothy D Beach
Terry Doiron

Principal Investigator:

Javier G Del Hoyo

Co-Investigators:

Manuel A Quijada
Vivek H Dwivedi
William C Danchi

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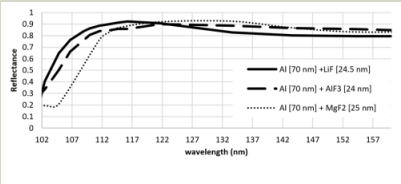
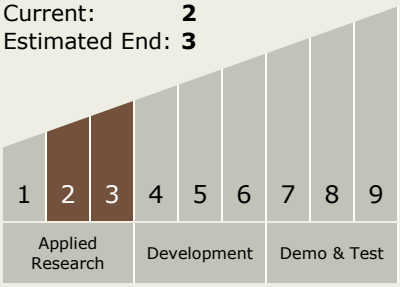
Images



GSFC enhanced protected aluminum coatings for the far-ultraviolet
State-of-the-art aluminum coating with different metal fluoride overcoats.
(https://techport.nasa.gov/image/28293)

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components

Target Destinations

Earth, Others Inside the Solar System, Outside the Solar System

Supported Mission Type

Projected Mission (Pull)